10/585210
IAP20 Rec'd PCT/PTO 03 JUL 2006
WO 2005/069691 PCT/EP2004/014766

Closing Mechanism Comprising a Heating Means, and Method for Producing One Such Closing Mechanism

The invention relates to a closing mechanism comprising a heating means, and a method for producing one such closing mechanism.

Generic adhesive fastener components are known for example from DE 196 46 318 A1. An adhesive fastener generally formed from two adhesive fastener components which can be dynamically joined to each other is often used in textile or other articles of clothing and is also known as a Velcro® fastener. Other applications are for example mounting technology, for example for fastening of elements of interior trim in automotive engineering, or generally the production of a detachable fastening.

The object of the invention is to increase the functionality of adhesive fastener components and adhesive fasteners and to make available the pertinent production process for such an adhesive fastener component.

This object is achieved by the adhesive fastener component defined in claim 1 and by the production process defined in the subordinate claims. Special versions of the invention are defined in the dependent claims.

In an adhesive fastener component with a plurality of adhesive fastener elements such as for example hooks, mushroom heads, or loops, the adhesive fastener component having a flat carrier and the adhesive fastener elements protruding from at least one surface of the carrier, the object is achieved in that the adhesive fastener component at least in certain sections has a heating means which converts supplied energy into heat.

By preference the heating means is applied to the carrier as flat resistance heating, and in addition to the actual resistance layer also electrode layers, cover layers, reflection layers for heat radiation, protective layers, etc., can be applied. The heating layer can be applied masked or unmasked, especially masked in the form of a resistance path, preferably a meander-shaped resistance path. Several resistance and/or connection paths which are electrically insulated against each other can also be applied on top of each other and/or next to each other.

The adhesive fastener component can preferably be easily deformed elastically or plastically and can be drawn into almost any shape. Preferably the adhesive fastener component can also be deep-drawn while retaining its adhesion capacity and heating capacity. Basically the heating means can be located on the carrier and/or in the carrier. Preferably the heating means can be applied in thick or thin film technology to the flat carrier of the adhesive fastener component or the heating means is applied to another carrier which is connected to the flat carrier of the adhesive fastener component, especially is laminated onto it.

The combination of adhesive fastener elements and heating means as claimed in the invention is advantageous also because the thermal expansion of the resistance path and/or of the other layers of the heating means and/or of the carrier which occurs in operation of the heating means can be accommodated by the adhesive fastener elements without the attachment of the adhesive fastener component being adversely affected or without for example flapping noise occurring due to loosening of an attachment. Moreover it is advantageous that the adhesive fastener

elements enable a flat connection of the heating means, and thus also especially good heat transfer to the heat consumer. The heating means with the carrier forms a unit so that a separate connection between the heating means and the adhesive fastener elements can be omitted.

Fundamentally all processes known from thick and thin film technology are possible for application of the heating means to the carrier of the adhesive fastener component. In one special embodiment of the invention, the heating means is applied to the flat carrier by screen printing or offset printing. With application of the heating means, printed conductors, terminal electrodes or other electrical and/or electronic components can also be produced at the same time.

To the extent the material of the flat carrier of the adhesive fastener component enables it, for example consists of a polymer plastic which is semiconductive at least in certain sections, or of the corresponding textile materials, active electronic components such as for example field effect transistors can also be monolithically integrated into the adhesive fastener component. It is also possible to integrate hybrid circuit electronics, for example to fix control circuits on especially thin and therefore flexible silicon substrates of less than 50 μm thickness, preferably less than 20 μm, on or in the carrier or to incorporate them into a textile carrier. Thus, for example a temperature measurement element, a thermostat element and/or a switching device can also be integrated, as is often necessary for operation of a heating means.

Power can be supplied by an external energy storage device, or the adhesive fastener component can have an energy storage device, especially an electrochemical energy storage device in thin or thick film technology.

Preferably the carrier and/or the adhesive fastener elements are made from a polymer plastic, especially from polyester or polyamide, for less stringent requirements for thermal stability also from polyolefins, such as for example polypropylene or polyethylene, or from a biodegradable

material or other suitable plastic. For many applications it is advantageous if the plastic is a duroplastic, for example an acrylate plastic, and in this case the crosslinking can be controlled by some amount of energy applied, especially by irradiation and/or by supplying heat. Alternatively to a duroplastic, the plastic can also be thermoplastically moldable and a method according to DE 196 46 318 A1 can be used to produce the adhesive fastener elements. Preferably the adhesive fastener elements are made integral with the carrier. The adhesive fastener elements can also be produced as described in DE 101 06 705 C1, especially with an application device by which the adhesive fastener elements are built up in successively delivered droplets.

In one embodiment of the invention, heating systems in almost any geometry can also be easily mounted at poorly accessible locations, with a high level of freedom of shapes, but in a space-saving manner and if necessary also detachably. For example, in this way, seat, mirror, interior or defrosting heating systems or the like which are simple to install can be implemented in motor vehicles, living spaces, or facilities in the open.

Moreover, as claimed in the invention, heating systems can be implemented for example for mechanical, pneumatic, hydraulic, electrical and electronic assemblies with which the heat energy can be supplied exactly to the required locations in a pin-point manner and with almost any freedom of shape. For this purpose, the heating means adapted to the application can also produce heat superficially in a non-uniform manner, for example by local variation of the resistance as a result of changes in the composition, thickness, or lateral geometry of the resistance layer.

The devices as claimed in the invention are thin, have a low weight, can be controlled in their heat output and/or heat distribution, and offer explosion-proof heating. Based on a combination with an adhesive fastener component, complex two- and three-dimensional geometries can be permanently and reliably supplied uniformly or with a definable heat distribution. The service life potential is long compared to known heating means, especially compared to heating

means which have a heating wire. Terminal and connection contacts, like trigger electronics, can be integrated into the adhesive fastener component. For example, a receiver can be integrated into the adhesive fastener component, by which a control signal can be received and thereupon the heating means is turned on and off.

By preference the heating means is located on the surface of the adhesive fastener component opposite the adhesive fastener elements. As an alternative, adhesive fastener elements can also protrude from the two surfaces of the carrier. There can also be a partial surface which is free of adhesive fastener elements on the surface which otherwise has adhesive fastener elements, for application of the heating means. In this way the heating means and/or its electrical contact is protected by the carrier in any case after attachment of the adhesive fastener component.

The carrier of the adhesive fastener component can also be a textile product, especially a product which has been produced by weaving, knitting, braiding, or embroidery. In this case for example individual threads or thread groups, especially warp and/or weft threads, of different plies of the textile product can be made as connecting leads, for example by their being formed by conductive filaments or having a conductive coating. Preferably the heating means is located between two plies of the textile carrier.

The invention also relates to a method for producing an adhesive fastener component with a heating means as described above, by the heating means being applied to the carrier which already has adhesive fastener elements. In one special embodiment of the invention the heating means is applied, especially printed, in thick or thin film technology, onto the flat carrier. This is especially advantageous when the adhesive fastener elements and the flat carrier are made in one piece by thermoplastic shaping.

An electrical contact geometry of the heating means is also possible by specifically influencing the electrical conductivity of individual or groups of adhesive fastener elements configured in a grid in regular structures. The adhesion of the heating means to be applied, that is, the adhesion of the heating means to the carrier of the adhesive fastener component, can be improved by surface treatment, especially by a gas atmosphere which increases the polarity of the carrier molecules near the surface. As an alternative or in addition, a adhesion-imparting coating, for example a polymer which differs from the carrier, can be applied to the carrier, especially when it consists of polyamide.

Further advantages, features, and details of the invention will be apparent from the dependent claims and the following description, in which with reference to the drawings several exemplary embodiments are described in particular. In this connection the features mentioned in the claims and in the description are essential for the invention individually or in any combination.

FIG. 1 shows a cross section through an adhesive fastener with an adhesive fastener component as claimed in the invention,

FIG. 2 shows a perspective of the adhesive fastener component similarly to the one in FIG. 1,

FIG. 3 shows a second exemplary embodiment of the invention,

FIG. 4 shows a third exemplary embodiment of the invention,

FIG. 5 shows a fourth exemplary embodiment of the invention,

FIG. 6 shows one application of the adhesive fastener component as claimed in the invention.

FIG. 1 shows a cross section through an adhesive fastener with an adhesive fastener component 1 as claimed in the invention. It has a plurality of adhesive fastener elements 2 which are configured regularly in rows and columns and which are formed integrally with a flat carrier 3 of thermoplastically moldable plastic, and protrude obliquely and preferably at a right angle from a first surface 4 of the carrier 3.

On the second surface 6 opposite the first surface 4, there is a heating means 5 on the carrier 3. The heating means 5 is applied in thick film technology, especially by screen printing, to the carrier which already has the adhesive fastener elements 2 and which has been completed in this respect, and in addition to an insulation layer 7 and a cover layer 9, has a structured heating layer 8 which is located in between and which is formed essentially by elongated resistance paths 10.

A material for the resistance path 10 can be for example resistance materials known from thick film technology, with which sheet resistances can be implemented in a wide range, for example between 2 and 1000 ohms per square. Resistance materials can also be used which have an electrical resistance which is largely independent of temperature. Alternatively, resistance materials with a definably positive or negative temperature coefficient of the resistivity can be used which implement a thermostat function during operation with a constant voltage or with a constant current.

Typical layer thicknesses are between 10 and 100 μm, especially between 20 and 50 μm. The heat outputs per unit of area depending on the application can be for example between 1 and 2000 watts per m^2, for individual or interior heating systems in motor vehicles especially between 100 and 300 watts per m^2. Heating optimized for the application can be implemented by the configuration and design of the resistance path 10 with respect to layer thickness, path width and

resistance material. Connecting leads which may be necessary can be produced with sheet resistances below 1 ohm per square, especially less than 0.25 ohm per square, for example also by silver enamels, copper enamels, carbon enamels and the like.

The layer thickness ratios both of the carrier 3 including the adhesive fastener elements 2 and also of the heating means 5 are not shown to scale in the figures, especially for purposes of depiction individual layers are shown enlarged. Moreover the heating means 5 can also have more than three layers, especially other layers for protection, for blocking moisture or for electrical insulation. The adhesive fastener component 1 as claimed in the invention can be joined, as shown in FIG. 1, to another adhesive fastener component 13 which is set up almost identically with respect to the carrier 3, in particular the adhesive fastener elements 2, 14 can be detachably engaged to one another, or can also be joined to a textile adhesive fastener element or an article of textile clothing.

FIG. 2 shows a perspective view of the adhesive fastener component 1 similarly to the one from FIG. 1, only the resistance path 10 which has been printed directly on the second surface 6 of the carrier 3 being shown. The resistance path 10 runs in a meander with variation both of the path width and also of the distance of adjacent path sections. Contact with the resistance path 10 can be made by way of terminal electrodes 15, 16, which are located next to each other on one common side of the adhesive fastener component 1.

FIG. 3 shows a second exemplary embodiment of the adhesive fastener component 101 as claimed in the invention. In this exemplary embodiment the adhesive fastener elements 102 are located on the same surface as the heating means 105. The area of the carrier 103 in which the heating means 105 is located is however free of adhesive fastener elements 102. On the same surface the connecting lead 115 for the resistance path 110 which has been printed in the insulation layer 107 is routed to the terminal protrusion 118.

Another adhesive fastener component 113 on its surface facing the adhesive fastener component 101 as claimed in the invention likewise has adhesive fastener elements 114 and a terminal protrusion 119 which is connected to the connecting lead 120. The adhesive fastener elements 102, 114 of the two adhesive fastener components 101, 113 are engaged to one another by pressing on them and at the same time the two terminal protrusions 118, 119 come into electrical contact. In this way, reliable contact with the resistance path 110 can be made by way of the connecting lead 120.

FIG. 4 shows a third exemplary embodiment of an adhesive fastener component 201 as claimed in the invention. The carrier 203 which preferably consists of a thermoplastic, like also the adhesive fastener elements 202 located in this area 221, is made electrically conductive by the corresponding modification of the plastic, as is indicated by the crosshatching, for example by intercalation of conductive particles. In these areas 221 the carrier 203 makes contact with the heating means 205 which is located on the second surface 206 and which has an insulation layer 207 which in the corresponding areas likewise has electrically conductive terminal electrodes 222 which are electrically connected to the electrically conductive adhesive fastener elements 202. In this way the adhesive fastener component 201 and especially the heating means 205 can make electrical contact with the back of the carrier 203 which is opposite the heating means 205, for example by way of external contact pieces 223.

Executing the heating means as a resistance layer also makes it possible to implement a pushbutton element 211 by structuring the resistance path 210. For this purpose, for example there can be an interruption of the resistance path 210. With the interposition of an electrically insulating intermediate layer 225 there is an conductive contact bridge 210a located over it, which under the action of a force according to the arrow 212 electrically closes the interruption as the cover layer 209 is deformed. The elasticity of the heating means 205 and/or of the carrier 203 ensures resetting of the pushbutton element 211 which is executed as a "make contact" in the exemplary embodiment.

FIG. 5 shows a fourth exemplary embodiment of an adhesive fastener component 301 as claimed in the invention which on both sides of the heating means 305 has one respective carrier 303, 303a with adhesive fastener elements 302, 302a on the surface facing away from the heating means 305. Between the insulation layer 307 and the cover layer 309 there are two resistance paths 310, 310a electrically insulated from each other by an intermediate layer 325, the lengthwise extension of the two resistance paths 310, 310a running obliquely to each other, especially at a right angle. The two resistance paths 310, 310a can be connected to each other by way of through-plating or externally and this can be electrically connected in series or parallel.

FIG. 6 shows one application of an adhesive fastener component 1 as claimed in the invention, simply for reasons of greater clarity the separating line between the carrier 3 and the heating means 5 (see FIG. 1) not being shown. The adhesive fastener component 1 is fixed by means of the adhesive fastener elements 2 on a support body 24, with a surface which is formed for example by a textile fleece material, or on its surface another adhesive fastener component 13 is fixed over the entire surface or in certain sections, for example as a deep-drawn part. The adhesive fastener component 1 in spite of the projecting structure of the support body 24 ensures uniform heating on all sides. The adhesive fastener component 1 as claimed in the invention can be formed as a deep-drawn part while maintaining the adhesion fastening capacity and the heating capacity so that in each instance even complexly shaped support bodies 24 fit precisely.